A PECULIAR CASE OF HEMLOCK MISTLETOE PARASITIC ON LARCH

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The British Columbia Forest Service in 1951 undertook to plant some *Larix europaea* in several localities in the Cowichan Lake area on Vancouver Island. One such locality was near the entrance of the Forest Experimental Station at Mesachie, where trees were planted in the immediate vicinity of old trees of *Tsuga heterophylla* severely infected with *Arceuthobium campylopodum*. Young hemlocks, part of the natural regeneration, also bore many vigorous infections or were about to become infected. In the spring of 1961 a small number of swellings were discovered on two of the larches. The largest swelling was a fusiform one of about 3 in. in length and 1 in. in thickness. One or two lateral branches which took their origin in the swollen area themselves showed some slight hypertrophy at the base. The striking thing at the time of the 1961 visit was the fact that no mistletoe shoots were present on any of the swellings. Consequently, some doubt remained as to the identification of the hypertrophies.

The area was revisited again two years later, in July, 1963. A total of 10 swellings were discovered on three larches. Some of these doubtlessly escaped detection during the earlier visit, but others had clearly developed since that time. The two largest infections had undergone little change except that the formation of a typical small broom was now under way in both cases (fig. 3). Short shoots on the swollen portion of the host branch had grown into long shoots (fig. 2), a process similar to that in some pines when attacked by *A. campylopodum* (Kuijt, 1960). A certain amount of necrosis and resin flow had occurred. Most surprisingly, a careful search revealed the complete absence of mistletoe shoots and buds.

It has been established since that time that the swellings are inhabited by the endophytic strands of *Arceuthobium*. The extra-cambial tissues of the host are traversed by many "cortical" strands, and many sinkers extend at least two or three years into the xylem. Abnormal rays are very frequent (Srivastava & Esau, 1961); in fact, normal ones can be located only with difficulty. The cells of the parasite in these abnormal rays are crowded with starch grains.

The most mystifying aspect of these infections is, of course, the complete absence of shoots or even the smallest buds on mistletoe individuals

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Figs. 1–3. Parasitism of *Arceuthobium campylopodum* on *Larix europaea*, Mesachie, British Columbia; 1, old infection with some indication of early brooming; cracking and rough texture of host trunk may indicate presence of the parasite within it; 2, very young infection showing fusiform swelling and change from short shoot to long shoot; 3, well developed young broom.


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which are estimated to be about 6 years old. Even in the case of the 5-year life cycle of the species on *Pinus monticola* (Kuijt, 1961) mistletoe buds were developed almost immediately after the hypertrophy was initiated, i.e., within two or three years following seed dispersal. In the larch infections, however, we are faced with infections even at the brooming stage without the slightest indication of buds. Although aerial mistletoe shoots may still appear in the years to come, we may be concerned here with a completely endophytic ("latent") mistletoe. The fact that the host branches of one infection had outgrown the swollen and somewhat broomed portion may support the contention of sterility of the mistletoe on this host (fig. 1).

The idea of latency in mistletoes is not a novel one. It has been alluded to both for *Phoradendron juniperinum* (Wagener, 1925), and *Arceuthobium*. Gill & Hawksworth (1961), for example, say: "The ability of the haustoria to live for long periods without benefit of aerial parts is well known in *Arceuthobium*." But in all such cases the period of latency seems to be a terminal, senescent one (Kuijt, 1960). This is implied by Gill (1935) when saying that in *Arceuthobium* "the endophytic system . . . may continue to live for years after shoot production has ceased." The present larch infections may never produce shoots.

These observations do not provide an unambiguous answer as to the question of host-specific races within *A. campylopodum*. It is true, on the one hand, that the hemlock mistletoe can become established on at least one species of larch. The physiological distinction, if any, separating "f. *laricis*" and "f. *tsugensis*" is therefore by no means complete. On the other hand, the behavior of the hemlock mistletoe on the European larch appears to be such as to preclude self-perpetuation. We must keep in mind here the possibility that the response of *L. europaea* to infection by *A. campylopodum* may be quite different from that of *L. occidentalis*. In other words, it is conceivable that the life cycle on the latter is relatively short, while development of shoots is delayed on the former host.

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